

CL-2028USPROV.ST25.txt
SEQUENCE LISTING

<110> E. I. duPont de Nemours and Company, Inc.
Cheng, Qiong
Rouviere, Pierre
Tao, Luan

<120> Mutations Affecting Carotenoid Production

<130> CL-2028 US NA

<150> US 60/435612

<151> 2002-12-19

<160> 43

<170> PatentIn version 3.2

<210> 1

<211> 912

<212> DNA

<213> Pantoea stewartii

<220>

<221> misc_feature

<222> (1)..(3)

<223> Alternative start code usage of TTG instead of ATG.

<400> 1

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| gctgatatcg atagccgcct tgatcagtta ctgccggttc agggtgagcg ggattgtgtg | 120 |
| ggtgccgcga tgcgtgaagg cacgctggca ccgggcaaac gtattcgtcc gatgctgctg | 180 |
| ttattaacag cgcgcatct tggctgtgcg atcagtcacg ggggattact ggatttagcc | 240 |
| tgcgcggttg aaatggtgca tgctgcctcg ctgattctgg atgatatgcc ctgcatggac | 300 |
| gatgctgcaga tgcgtcgggg gcgtccacc attcacacgc agtacggtga acatgtggcg | 360 |
| attctggcgg cggtcgcttt actcagcaaa gcgtttgggg tgattgccga ggctgaaggt | 420 |
| ctgacgccga tagccaaaac tcgcgcggtg tcggagctgt cactgcatg tggcatgcag | 480 |
| ggtctggttc agggccagtt taaggacctc tcggaaggcg ataaaccccg cagcgccgat | 540 |
| gccatactgc taaccaatca gtttaaaacc agcacgctgt tttgcgcgtc aacgcaaattg | 600 |
| gcgtccattg cggccaacgc gtcctgcgaa gcgcgtgaga acctgcatcg tttctcgtc | 660 |
| gatctcggcc aggcctttca gttgcttgac gatcttaccg atggcatgac cgataccggc | 720 |
| aaagacatca atcaggatgc aggtaaatca acgctggtca atttattagg ctcaggcgcg | 780 |
| gtcgaagaac gcctgcgaca gcatttgctc ctggccagtg aacacctttc cgcgccatgc | 840 |
| caaaacggcc attccaccac ccaacttttt attcaggcct ggtttgacaa aaaactcgct | 900 |
| gccgtcagtt aa | 912 |

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<211> 303

<212> PRT

<213> Pantoea stewartii

<400> 2

Met Thr Val Cys Ala Lys Lys His Val His Leu Thr Gly Ile Ser Ala
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 Glu Gln Leu Leu Ala Asp Ile Asp Ser Arg Leu Asp Gln Leu Leu Pro
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 Val Gln Gly Glu Arg Asp Cys Val Gly Ala Ala Met Arg Glu Gly Thr
 35 40 45
 Leu Ala Pro Gly Lys Arg Ile Arg Pro Met Leu Leu Leu Thr Ala
 50 55 60
 Arg Asp Leu Gly Cys Ala Ile Ser His Gly Gly Leu Leu Asp Leu Ala
 65 70 75 80
 Cys Ala Val Glu Met Val His Ala Ala Ser Leu Ile Leu Asp Asp Met
 85 90 95
 Pro Cys Met Asp Asp Ala Gln Met Arg Arg Gly Arg Pro Thr Ile His
 100 105 110
 Thr Gln Tyr Gly Glu His Val Ala Ile Leu Ala Ala Val Ala Leu Leu
 115 120 125
 Ser Lys Ala Phe Gly Val Ile Ala Glu Ala Glu Gly Leu Thr Pro Ile
 130 135 140
 Ala Lys Thr Arg Ala Val Ser Glu Leu Ser Thr Ala Ile Gly Met Gln
 145 150 155 160
 Gly Leu Val Gln Gly Gln Phe Lys Asp Leu Ser Glu Gly Asp Lys Pro
 165 170 175
 Arg Ser Ala Asp Ala Ile Leu Leu Thr Asn Gln Phe Lys Thr Ser Thr
 180 185 190
 Leu Phe Cys Ala Ser Thr Gln Met Ala Ser Ile Ala Ala Asn Ala Ser
 195 200 205
 Cys Glu Ala Arg Glu Asn Leu His Arg Phe Ser Leu Asp Leu Gly Gln
 210 215 220
 Ala Phe Gln Leu Leu Asp Asp Leu Thr Asp Gly Met Thr Asp Thr Gly
 225 230 235 240
 Lys Asp Ile Asn Gln Asp Ala Gly Lys Ser Thr Leu Val Asn Leu Leu
 245 250 255
 Gly Ser Gly Ala Val Glu Glu Arg Leu Arg Gln His Leu Arg Leu Ala
 260 265 270

Ser Glu His Leu Ser Ala Ala Cys Gln Asn Gly His Ser Thr Thr Gln
 275 280 285

Leu Phe Ile Gln Ala Trp Phe Asp Lys Lys Leu Ala Ala Val Ser
 290 295 300

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 1 5 10 15
 gct ctg caa aac ctt gct cag gaa tta gtg gcc cgc ggt cat cgt gtt 96
 Ala Leu Gln Asn Leu Ala Gln Glu Leu Val Ala Arg Gly His Arg Val
 20 25 30
 acg ttt ttt cag caa cat gac tgc aaa gcg ctg gta acg ggc agc gat 144
 Thr Phe Phe Gln Gln His Asp Cys Lys Ala Leu Val Thr Gly Ser Asp
 35 40 45
 atc gga ttc cag acc gtc gga ctg caa acg cat cct ccc ggt tcc tta 192
 Ile Gly Phe Gln Thr Val Gly Leu Gln Thr His Pro Pro Gly Ser Leu
 50 55 60
 tcg cac ctg ctg cac ctg gcc gcg cac cca ctc gga ccc tcg atg tta 240
 Ser His Leu Leu His Leu Ala Ala His Pro Leu Gly Pro Ser Met Leu
 65 70 75 80
 cga ctg atc aat gaa atg gca cgt acc agc gat atg ctt tgc cgg gaa 288
 Arg Leu Ile Asn Glu Met Ala Arg Thr Ser Asp Met Leu Cys Arg Glu
 85 90 95
 ctg ccc gcc gct ttt cat gcg ttg cag ata gag ggc gtg atc gtt gat 336
 Leu Pro Ala Ala Phe His Ala Leu Gln Ile Glu Gly Val Ile Val Asp
 100 105 110
 caa atg gag ccg gca ggt gca gta gtc gca gaa gcg tca ggt ctg ccg 384
 Gln Met Glu Pro Ala Gly Ala Val Val Ala Glu Ala Ser Gly Leu Pro
 115 120 125
 ttt gtt tcg gtg gcc tgc gcg ctg ccg ctc aac cgc gaa ccg ggt ttg 432
 Phe Val Ser Val Ala Cys Ala Leu Pro Leu Asn Arg Glu Pro Gly Leu
 130 135 140
 cct ctg gcg gtg atg cct ttc gag tac ggc acc agc gat gcg gct cgg 480
 Pro Leu Ala Val Met Pro Phe Glu Tyr Gly Thr Ser Asp Ala Ala Arg
 145 150 155 160
 gaa cgc tat acc acc agc gaa aaa att tat gac tgg ctg atg cga cgt 528
 Glu Arg Tyr Thr Thr Ser Glu Lys Ile Tyr Asp Trp Leu Met Arg Arg
 165 170 175
 cac gat cgt gtg atc gcg cat cat gca tgc aga atg ggt tta gcc ccg 576
 His Asp Arg Val Ile Ala His His Ala Cys Arg Met Gly Leu Ala Pro
 180 185 190

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| | |
|--|------|
| cgt gaa aaa ctg cat cat tgt ttt tct cca ctg gca caa atc agc cag Arg Glu Lys 195 Leu His His Cys Phe 200 Ser Pro Leu Ala Gln 205 Ile Ser Gln | 624 |
| ttg atc ccc gaa ctg gat ttt ccc cgc aaa gcg ctg cca gac tgc ttt Leu Ile Pro 210 Glu Leu Asp Phe 215 Pro Arg Lys Ala Leu 220 Pro Asp Cys Phe | 672 |
| cat gcg gtt gga ccg tta cgg caa ccc cag ggg acg ccg ggg tca tca His Ala Val 225 Gly Pro 230 Arg Gln Pro Gln Gly Thr Pro Gly Ser Ser 240 | 720 |
| act tct tat ttt ccg tcc ccg gac aaa ccc cgt att ttt gcc tcg ctg Thr Ser Tyr Phe Pro 245 Ser Pro Asp Lys Pro 250 Arg Ile Phe Ala Ser 255 Leu | 768 |
| ggc acc ctg cag gga cat cgt tat ggc ctg ttc agg acc atc gcc aaa Gly Thr Leu 260 Gln Gly His Arg Tyr Gly Leu Phe Arg Thr Ile Ala Lys | 816 |
| gcc tgc gaa gag gtg gat gcg cag tta ctg ttg gca cac tgt ggc ggc Ala Cys Glu 275 Glu Val Asp Ala Gln Leu Leu Leu Ala His 285 Cys Gly Gly | 864 |
| ctc tca gcc acg cag gca ggt gaa ctg gcc cgg ggc ggg gac att cag Leu Ser 290 Ala Thr Gln Ala Gly 295 Glu Leu Ala Arg Gly 300 Gly Asp Ile Gln | 912 |
| gtt gtg gat ttt gcc gat caa tcc gca gca ctt tca cag gca cag ttg Val Val Asp Phe Ala Asp 310 Gln Ser Ala Ala Leu 315 Ser Gln Ala Gln Leu 320 | 960 |
| aca atc aca cat ggt ggg atg aat acg gta ctg gac gct att gct tcc Thr Ile Thr His Gly 325 Gly Met Asn Thr Val 330 Leu Asp Ala Ile 335 Ser | 1008 |
| cgc aca ccg cta ctg gcg ctg ccg ctg gca ttt gat caa cct ggc gtg Arg Thr Pro 340 Leu Leu Ala Leu Pro 345 Leu Ala Phe Asp Gln Pro 350 Gly Val | 1056 |
| gca tca cga att gtt tat cat ggc atc ggc aag cgt gcg tct cgg ttt Ala Ser Arg 355 Ile Val Tyr His Gly 360 Ile Gly Lys Arg Ala 365 Ser Arg Phe | 1104 |
| act acc agc cat gcg ctg gcg cgg cag att cga tcg ctg ctg act aac Thr Thr 370 Ser His Ala Leu 375 Arg Gln Ile Arg Ser 380 Leu Leu Thr Asn | 1152 |
| acc gat tac ccg cag cgt atg aca aaa att cag gcc gca ttg cgt ctg Thr Asp Tyr Pro 385 Gln Arg Met Thr Lys Ile Gln Ala Ala Leu Arg Leu 400 | 1200 |
| gca ggc ggc aca cca gcc gcc gcc gat att gtt gaa cag gcg atg cgg Ala Gly Gly Thr 405 Pro Ala Ala Ala Asp Ile Val Glu Gln Ala Met 415 Arg | 1248 |
| acc tgt cag cca gta ctc agt ggg cag gat tat gca acc gca cta tga Thr Cys Gln 420 Pro Val Leu Ser Gly Gln 425 Asp Tyr Ala Thr Ala 430 Leu | 1296 |

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 <213> Pantoea stewartii
 <400> 4

Met Ser His Phe Ala Val Ile Ala Pro Pro Phe Phe Ser His Val Arg
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 Ala Leu Gln Asn Leu Ala Gln Glu Leu Val Ala Arg Gly His Arg Val
 20 25 30
 Thr Phe Phe Gln Gln His Asp Cys Lys Ala Leu Val Thr Gly Ser Asp
 35 40 45
 Ile Gly Phe Gln Thr Val Gly Leu Gln Thr His Pro Pro Gly Ser Leu
 50 55 60
 Ser His Leu Leu His Leu Ala Ala His Pro Leu Gly Pro Ser Met Leu
 65 70 75 80
 Arg Leu Ile Asn Glu Met Ala Arg Thr Ser Asp Met Leu Cys Arg Glu
 85 90 95
 Leu Pro Ala Ala Phe His Ala Leu Gln Ile Glu Gly Val Ile Val Asp
 100 105 110
 Gln Met Glu Pro Ala Gly Ala Val Val Ala Glu Ala Ser Gly Leu Pro
 115 120 125
 Phe Val Ser Val Ala Cys Ala Leu Pro Leu Asn Arg Glu Pro Gly Leu
 130 135 140
 Pro Leu Ala Val Met Pro Phe Glu Tyr Gly Thr Ser Asp Ala Ala Arg
 145 150 155 160
 Glu Arg Tyr Thr Thr Ser Glu Lys Ile Tyr Asp Trp Leu Met Arg Arg
 165 170 175
 His Asp Arg Val Ile Ala His His Ala Cys Arg Met Gly Leu Ala Pro
 180 185 190
 Arg Glu Lys Leu His His Cys Phe Ser Pro Leu Ala Gln Ile Ser Gln
 195 200 205
 Leu Ile Pro Glu Leu Asp Phe Pro Arg Lys Ala Leu Pro Asp Cys Phe
 210 215 220
 His Ala Val Gly Pro Leu Arg Gln Pro Gln Gly Thr Pro Gly Ser Ser
 225 230 235 240
 Thr Ser Tyr Phe Pro Ser Pro Asp Lys Pro Arg Ile Phe Ala Ser Leu
 245 250 255
 Gly Thr Leu Gln Gly His Arg Tyr Gly Leu Phe Arg Thr Ile Ala Lys
 260 265 270

Ala Cys Glu Glu Val Asp Ala Gln Leu Leu Leu Ala His Cys Gly Gly
 275 280 285

Leu Ser Ala Thr Gln Ala Gly Glu Leu Ala Arg Gly Gly Asp Ile Gln
 290 295 300

Val Val Asp Phe Ala Asp Gln Ser Ala Ala Leu Ser Gln Ala Gln Leu
 305 310 315 320

Thr Ile Thr His Gly Gly Met Asn Thr Val Leu Asp Ala Ile Ala Ser
 325 330 335

Arg Thr Pro Leu Leu Ala Leu Pro Leu Ala Phe Asp Gln Pro Gly Val
 340 345 350

Ala Ser Arg Ile Val Tyr His Gly Ile Gly Lys Arg Ala Ser Arg Phe
 355 360 365

Thr Thr Ser His Ala Leu Ala Arg Gln Ile Arg Ser Leu Leu Thr Asn
 370 375 380

Thr Asp Tyr Pro Gln Arg Met Thr Lys Ile Gln Ala Ala Leu Arg Leu
 385 390 395 400

Ala Gly Gly Thr Pro Ala Ala Ala Asp Ile Val Glu Gln Ala Met Arg
 405 410 415

Thr Cys Gln Pro Val Leu Ser Gly Gln Asp Tyr Ala Thr Ala Leu
 420 425 430

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 <222> (1)..(1149)

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 1 5 10 15

ggc ctt atc gcg ctc cgg ctt cag caa cag cat ccg gat atg cgg atc 96
 Gly Leu Ile Ala Leu Arg Leu Gln Gln His Pro Asp Met Arg Ile
 20 25 30

ttg ctt att gag gcg ggt cct gag gcg gga ggg aac cat acc tgg tcc 144
 Leu Leu Ile Glu Ala Gly Pro Glu Ala Gly Gly Asn His Thr Trp Ser
 35 40 45

ttt cac gaa gag gat tta acg ctg aat cag cat cgc tgg ata gcg ccg 192
 Phe His Glu Glu Asp Leu Thr Leu Asn Gln His Arg Trp Ile Ala Pro
 50 55 60

| | | | | | | | | | | | | | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|
| ctt Leu 65 | gtg Val | gtc Val | cat His | cac His | tgg Trp 70 | ccc Pro | gac Asp | tac Tyr | cag Gln | gtt Val 75 | cgt Arg | ttc Phe | ccc Pro | caa Gln | cgc Arg 80 | 240 |
| cgt Arg | cgc Arg | cat His | gtg Val | aac Asn 85 | agt Ser | ggc Gly | tac Tyr | tac Tyr | tgc Cys 90 | gtg Val | acc Thr | tcc Ser | cgg Arg | cat His 95 | ttc Phe | 288 |
| gcc Ala | ggg Gly | ata Ile | ctc Leu 100 | cgg Arg | caa Gln | cag Gln | ttt Phe | gga Gly 105 | caa Gln | cat His | tta Leu | tgg Trp | ctg Leu 110 | cat His | acc Thr | 336 |
| gcg Ala | gtt Val | tca Ser 115 | gcc Ala | gtt Val | cat His | gct Ala | gaa Glu 120 | tcg Ser | gtc Val | cag Gln | tta Leu | gcg Ala 125 | gat Asp | ggc Gly | cgg Arg | 384 |
| att Ile 130 | att Ile | cat His | gcc Ala | agt Ser | aca Thr | gtg Val 135 | atc Ile | gac Asp | gga Gly | cgg Arg | ggt Gly 140 | tac Tyr | acg Thr | cct Pro | gat Asp | 432 |
| tct Ser 145 | gca Ala | cta Leu | cgc Arg | gta Val | gga Gly 150 | ttc Phe | cag Gln | gca Ala | ttt Phe | atc Ile 155 | ggt Gly | cag Gln | gag Glu | tgg Trp | caa Gln 160 | 480 |
| ctg Leu | agc Ser | gcg Ala | ccg Pro | cat His 165 | ggt Gly | tta Leu | tcg Ser | tca Ser | ccg Pro 170 | att Ile | atc Ile | atg Met | gat Asp | gcg Ala 175 | acg Thr | 528 |
| gtc Val | gat Asp | cag Gln | caa Gln 180 | aat Asn | ggc Gly | tac Tyr | cgc Arg | ttt Phe 185 | gtt Val | tat Tyr | acc Thr | ctg Leu | ccg Pro 190 | ctt Leu | tcc Ser | 576 |
| gca Ala | acc Thr | gca Ala 195 | ctg Leu | ctg Leu | atc Ile | gaa Glu | gac Asp 200 | aca Thr | cac His | tac Tyr | att Ile | gac Asp 205 | aag Lys | gct Ala | aat Asn | 624 |
| ctt Leu | cag Gln 210 | gcc Ala | gaa Glu | cgg Arg | gcg Ala | cgt Arg 215 | cag Gln | aac Asn | att Ile | cgc Arg | gat Asp 220 | tat Tyr | gct Ala | gcg Ala | cga Arg | 672 |
| cag Gln 225 | ggt Gly | tgg Trp | ccg Pro | tta Leu | cag Gln 230 | acg Thr | ttg Leu | ctg Leu | cgg Arg | gaa Glu 235 | gaa Glu | cag Gln | ggt Gly | gca Ala | ttg Leu 240 | 720 |
| ccc Pro | att Ile | acg Thr | tta Leu | acg Thr 245 | ggc Gly | gat Asp | aat Asn | cgt Arg | cag Gln 250 | ttt Phe | tgg Trp | caa Gln | cag Gln | caa Gln 255 | ccg Pro | 768 |
| caa Gln | gcc Ala | tgt Cys | agc Ser 260 | gga Gly | tta Leu | cgc Arg | gcc Ala | ggg Gly 265 | ctg Leu | ttt Phe | cat His | ccg Pro | aca Thr 270 | acc Thr | ggc Gly | 816 |
| tac Tyr | tcc Ser | cta Leu 275 | ccg Pro | ctc Leu | gcg Ala | gtg Val | gcg Ala 280 | ctg Leu | gcc Ala | gat Asp | cgt Arg | ctc Leu 285 | agc Ser | gcg Ala | ctg Leu | 864 |
| gat Asp 290 | gtg Val | ttt Phe | acc Thr | tct Ser | tcc Ser | tct Ser 295 | gtt Val | cac His | cag Gln | acg Thr | att Ile 300 | gct Ala | cac His | ttt Phe | gcc Ala | 912 |
| cag Gln 305 | caa Gln | cgt Arg | tgg Trp | cag Gln | caa Gln 310 | cag Gln | ggg Gly | ttt Phe | ttc Phe | cgc Arg 315 | atg Met | ctg Leu | aat Asn | cgc Arg | atg Met 320 | 960 |
| ttg Leu | ttt Phe | tta Leu | gcc Ala | gga Gly 325 | ccg Pro | gcc Ala | gag Glu | tca Ser | cgc Arg 330 | tgg Trp | cgt Arg | gtg Val | atg Met | cag Gln 335 | cgt Arg | 1008 |

ttc tat ggc tta ccc gag gat ttg att gcc cgc ttt tat gcg gga aaa 1056
 Phe Tyr Gly Leu Pro Glu Asp Leu Ile Ala Arg Phe Tyr Ala Gly Lys
 340 345 350

ctc acc gtg acc gat cgg cta cgc att ctg agc ggc aag ccg ccc gtt 1104
 Leu Thr Val Thr Asp Arg Leu Arg Ile Leu Ser Gly Lys Pro Pro Val
 355 360 365

ccc gtt ttc gcg gca ttg cag gca att atg acg act cat cgt tga 1149
 Pro Val Phe Ala Ala Leu Gln Ala Ile Met Thr Thr His Arg
 370 375 380

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 <213> Pantoea stewartii

<400> 6

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Gly Leu Ile Ala Leu Arg Leu Gln Gln Gln His Pro Asp Met Arg Ile
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Leu Leu Ile Glu Ala Gly Pro Glu Ala Gly Gly Asn His Thr Trp Ser
 35 40 45

Phe His Glu Glu Asp Leu Thr Leu Asn Gln His Arg Trp Ile Ala Pro
 50 55 60

Leu Val Val His His Trp Pro Asp Tyr Gln Val Arg Phe Pro Gln Arg
 65 70 75 80

Arg Arg His Val Asn Ser Gly Tyr Tyr Cys Val Thr Ser Arg His Phe
 85 90 95

Ala Gly Ile Leu Arg Gln Gln Phe Gly Gln His Leu Trp Leu His Thr
 100 105 110

Ala Val Ser Ala Val His Ala Glu Ser Val Gln Leu Ala Asp Gly Arg
 115 120 125

Ile Ile His Ala Ser Thr Val Ile Asp Gly Arg Gly Tyr Thr Pro Asp
 130 135 140

Ser Ala Leu Arg Val Gly Phe Gln Ala Phe Ile Gly Gln Glu Trp Gln
 145 150 155 160

Leu Ser Ala Pro His Gly Leu Ser Ser Pro Ile Ile Met Asp Ala Thr
 165 170 175

Val Asp Gln Gln Asn Gly Tyr Arg Phe Val Tyr Thr Leu Pro Leu Ser
 180 185 190

Ala Thr Ala Leu Leu Ile Glu Asp Thr His Tyr Ile Asp Lys Ala Asn
 195 200 205

Leu Gln Ala Glu Arg Ala Arg Gln Asn Ile Arg Asp Tyr Ala Ala Arg
 210 215 220

Gln Gly Trp Pro Leu Gln Thr Leu Leu Arg Glu Glu Gln Gly Ala Leu
 225 230 235 240

Pro Ile Thr Leu Thr Gly Asp Asn Arg Gln Phe Trp Gln Gln Gln Pro
 245 250 255

Gln Ala Cys Ser Gly Leu Arg Ala Gly Leu Phe His Pro Thr Thr Gly
 260 265 270

Tyr Ser Leu Pro Leu Ala Val Ala Leu Ala Asp Arg Leu Ser Ala Leu
 275 280 285

Asp Val Phe Thr Ser Ser Ser Val His Gln Thr Ile Ala His Phe Ala
 290 295 300

Gln Gln Arg Trp Gln Gln Gln Gly Phe Phe Arg Met Leu Asn Arg Met
 305 310 315 320

Leu Phe Leu Ala Gly Pro Ala Glu Ser Arg Trp Arg Val Met Gln Arg
 325 330 335

Phe Tyr Gly Leu Pro Glu Asp Leu Ile Ala Arg Phe Tyr Ala Gly Lys
 340 345 350

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 355 360 365

Pro Val Phe Ala Ala Leu Gln Ala Ile Met Thr Thr His Arg
 370 375 380

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| Met Lys Pro Thr Thr Val Ile Gly Ala Gly Phe Gly Gly Leu Ala Leu | |
| 1 5 10 15 | |
| gca att cgt tta cag gcc gca ggt att cct gtt ttg ctg ctt gag cag | 96 |
| Ala Ile Arg Leu Gln Ala Ala Gly Ile Pro Val Leu Leu 30 | |
| 20 | |
| cgc gac aag ccg ggt ggc cgg gct tat gtt tat cag gag cag ggc ttt | 144 |
| Page 9 | |

| Arg | Asp | Lys | Pro | Gly | Gly | Arg | Ala | Tyr | Val | Tyr | Gln | Glu | Gln | Gly | Phe | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | 35 | | | | | 40 | | | | | 45 | | | | |
| act | ttt | gat | gca | ggc | cct | acc | ggt | atc | acc | gat | ccc | agc | gcg | att | gaa | 192 |
| Thr | Phe | Asp | Ala | Gly | Pro | Thr | Val | Ile | Thr | Asp | Pro | Ser | Ala | Ile | Glu | |
| | 50 | | | | | 55 | | | | | 60 | | | | | |
| gaa | ctg | ttt | gct | ctg | gcc | ggt | aaa | cag | ctt | aag | gat | tac | gtc | gag | ctg | 240 |
| Glu | Leu | Phe | Ala | Leu | Ala | Gly | Lys | Gln | Leu | Lys | Asp | Tyr | Val | Glu | Leu | |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 | |
| ttg | ccg | gtc | acg | ccg | ttt | tat | cgc | ctg | tgc | tgg | gag | tcc | ggc | aag | gtc | 288 |
| Leu | Pro | Val | Thr | Pro | Phe | Tyr | Arg | Leu | Cys | Trp | Glu | Ser | Gly | Lys | Val | |
| | | | | 85 | | | | | 90 | | | | | 95 | | |
| ttc | aat | tac | gat | aac | gac | cag | gcc | cag | tta | gaa | gcg | cag | ata | cag | cag | 336 |
| Phe | Asn | Tyr | Asp | Asn | Asp | Gln | Ala | Gln | Leu | Glu | Ala | Gln | Ile | Gln | Gln | |
| | | | 100 | | | | | 105 | | | | | 110 | | | |
| ttt | aat | ccg | cgc | gat | ggt | gcg | ggt | tat | cga | gcg | ttc | ctt | gac | tat | tcg | 384 |
| Phe | Asn | Pro | Arg | Asp | Val | Ala | Gly | Tyr | Arg | Ala | Phe | Leu | Asp | Tyr | Ser | |
| | | 115 | | | | | 120 | | | | | 125 | | | | |
| cgt | gcc | gta | ttc | aat | gag | ggc | tat | ctg | aag | ctc | ggc | act | gtg | cct | ttt | 432 |
| Arg | Ala | Val | Phe | Asn | Glu | Gly | Tyr | Leu | Lys | Leu | Gly | Thr | Val | Pro | Phe | |
| | 130 | | | | | 135 | | | | | 140 | | | | | |
| tta | tcg | ttc | aaa | gac | atg | ctt | cgg | gcc | gcg | ccc | cag | ttg | gca | aag | ctg | 480 |
| Leu | Ser | Phe | Lys | Asp | Met | Leu | Arg | Ala | Ala | Pro | Gln | Leu | Ala | Lys | Leu | |
| 145 | | | | | 150 | | | | | 155 | | | | | 160 | |
| cag | gca | tgg | cgc | agc | ggt | tac | agt | aaa | ggt | gcc | ggc | tac | att | gag | gat | 528 |
| Gln | Ala | Trp | Arg | Ser | Val | Tyr | Ser | Lys | Val | Ala | Gly | Tyr | Ile | Glu | Asp | |
| | | | | 165 | | | | | 170 | | | | | 175 | | |
| gag | cat | ctt | cgg | cag | gcg | ttt | tct | ttt | cac | tcg | ctc | tta | gtg | ggg | ggg | 576 |
| Glu | His | Leu | Arg | Gln | Ala | Phe | Ser | Phe | His | Ser | Leu | Leu | Val | Gly | Gly | |
| | | | 180 | | | | | 185 | | | | | 190 | | | |
| aat | ccg | ttt | gca | acc | tcg | tcc | att | tat | acg | ctg | att | cac | gcg | tta | gaa | 624 |
| Asn | Pro | Phe | Ala | Thr | Ser | Ser | Ile | Tyr | Thr | Leu | Ile | His | Ala | Leu | Glu | |
| | | 195 | | | | | 200 | | | | | 205 | | | | |
| cgg | gaa | tgg | ggc | gtc | tgg | ttt | cca | cgc | ggt | gga | acc | ggt | gcg | ctg | gtc | 672 |
| Arg | Glu | Trp | Gly | Val | Trp | Phe | Pro | Arg | Gly | Gly | Thr | Gly | Ala | Leu | Val | |
| | 210 | | | | | 215 | | | | | 220 | | | | | |
| aat | ggc | atg | atc | aag | ctg | ttt | cag | gat | ctg | ggc | ggc | gaa | gtc | gtg | ctt | 720 |
| Asn | Gly | Met | Ile | Lys | Leu | Phe | Gln | Asp | Leu | Gly | Gly | Glu | Val | Val | Leu | |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 | |
| aac | gcc | cgg | gtc | agt | cat | atg | gaa | acc | ggt | ggg | gac | aag | att | cag | gcc | 768 |
| Asn | Ala | Arg | Val | Ser | His | Met | Glu | Thr | Val | Gly | Asp | Lys | Ile | Gln | Ala | |
| | | | | 245 | | | | | 250 | | | | | 255 | | |
| gtg | cag | ttg | gaa | gac | ggc | aga | cgg | ttt | gaa | acc | tgc | gcg | gtg | gcg | tcg | 816 |
| Val | Gln | Leu | Glu | Asp | Gly | Arg | Arg | Phe | Glu | Thr | Cys | Ala | Val | Ala | Ser | |
| | | | 260 | | | | | 265 | | | | | 270 | | | |
| aac | gct | gat | gtt | gta | cat | acc | tat | cgc | gat | ctg | ctg | tct | cag | cat | ccc | 864 |
| Asn | Ala | Asp | Val | Val | His | Thr | Tyr | Arg | Asp | Leu | Leu | Ser | Gln | His | Pro | |
| | | 275 | | | | | 280 | | | | | 285 | | | | |
| gca | gcc | gct | aag | cag | gcg | aaa | aaa | ctg | caa | tcc | aag | cgt | atg | agt | aac | 912 |
| Ala | Ala | Ala | Lys | Gln | Ala | Lys | Lys | Leu | Gln | Ser | Lys | Arg | Met | Ser | Asn | |
| | 290 | | | | | 295 | | | | | 300 | | | | | |
| tca | ctg | ttt | gta | ctc | tat | ttt | ggt | ctc | aac | cat | cat | cac | gat | caa | ctc | 960 |

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Ser Leu Phe Val Leu Tyr Phe Gly Leu Asn His His His Asp Gln Leu
 305 310 315 320
 gcc cat cat acc gtc tgt ttt ggg cca cgc tac cgt gaa ctg att cac 1008
 Ala His His Thr Val Cys Phe Gly Pro Arg Tyr Arg Glu Leu Ile His
 325 330 335
 gaa att ttt aac cat gat ggt ctg gct gag gat ttt tcg ctt tat tta 1056
 Glu Ile Phe Asn His Asp Gly Leu Ala Glu Asp Phe Ser Leu Tyr Leu
 340 345 350
 cac gca cct tgt gtc acg gat ccg tca ctg gca ccg gaa ggg tgc ggc 1104
 His Ala Pro Cys Val Thr Asp Pro Ser Leu Ala Pro Glu Gly Cys Gly
 355 360 365
 agc tat tat gtg ctg gcg cct gtt cca cac tta ggc acg gcg aac ctc 1152
 Ser Tyr Tyr Val Leu Ala Pro Val Pro His Leu Gly Thr Ala Asn Leu
 370 375 380
 gac tgg gcg gta gaa gga ccc cga ctg cgc gat cgt att ttt gac tac 1200
 Asp Trp Ala Val Glu Gly Pro Arg Leu Arg Asp Arg Ile Phe Asp Tyr
 385 390 395 400
 ctt gag caa cat tac atg cct ggc ttg cga agc cag ttg gtg acg cac 1248
 Leu Glu Gln His Tyr Met Pro Gly Leu Arg Ser Gln Leu Val Thr His
 405 410 415
 cgt atg ttt acg ccg ttc gat ttc cgc gac gag ctc aat gcc tgg caa 1296
 Arg Met Phe Thr Pro Phe Asp Phe Arg Asp Glu Leu Asn Ala Trp Gln
 420 425 430
 ggt tcg gcc ttc tcg gtt gaa cct att ctg acc cag agc gcc tgg ttc 1344
 Gly Ser Ala Phe Ser Val Glu Pro Ile Leu Thr Gln Ser Ala Trp Phe
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 cga cca cat aac gcg gat aag cac att gat aat ctt tat ctg gtt ggc 1392
 Arg Pro His Asn Arg Asp Lys His Ile Asp Asn Leu Tyr Leu Val Gly
 450 455 460
 gca ggc acc cat cct ggc gcg ggc att ccc ggc gta atc ggc tcg gcg 1440
 Ala Gly Thr His Pro Gly Ala Gly Ile Pro Gly Val Ile Gly Ser Ala
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 Lys Ala Thr Ala Gly Leu Met Leu Glu Asp Leu Ile
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35 40 45

Thr Phe Asp Ala Gly Pro Thr Val Ile Thr Asp Pro Ser Ala Ile Glu
Page 11

50

55

60

Glu Leu Phe Ala Leu Ala Gly Lys Gln Leu Lys Asp Tyr Val Glu Leu
65 70 75 80

Leu Pro Val Thr Pro Phe Tyr Arg Leu Cys Trp Glu Ser Gly Lys Val
85 90 95

Phe Asn Tyr Asp Asn Asp Gln Ala Gln Leu Glu Ala Gln Ile Gln Gln
100 105 110

Phe Asn Pro Arg Asp Val Ala Gly Tyr Arg Ala Phe Leu Asp Tyr Ser
115 120 125

Arg Ala Val Phe Asn Glu Gly Tyr Leu Lys Leu Gly Thr Val Pro Phe
130 135 140

Leu Ser Phe Lys Asp Met Leu Arg Ala Ala Pro Gln Leu Ala Lys Leu
145 150 155 160

Gln Ala Trp Arg Ser Val Tyr Ser Lys Val Ala Gly Tyr Ile Glu Asp
165 170 175

Glu His Leu Arg Gln Ala Phe Ser Phe His Ser Leu Leu Val Gly Gly
180 185 190

Asn Pro Phe Ala Thr Ser Ser Ile Tyr Thr Leu Ile His Ala Leu Glu
195 200 205

Arg Glu Trp Gly Val Trp Phe Pro Arg Gly Gly Thr Gly Ala Leu Val
210 215 220

Asn Gly Met Ile Lys Leu Phe Gln Asp Leu Gly Gly Glu Val Val Leu
225 230 235 240

Asn Ala Arg Val Ser His Met Glu Thr Val Gly Asp Lys Ile Gln Ala
245 250 255

Val Gln Leu Glu Asp Gly Arg Arg Phe Glu Thr Cys Ala Val Ala Ser
260 265 270

Asn Ala Asp Val Val His Thr Tyr Arg Asp Leu Leu Ser Gln His Pro
275 280 285

Ala Ala Ala Lys Gln Ala Lys Lys Leu Gln Ser Lys Arg Met Ser Asn
290 295 300

Ser Leu Phe Val Leu Tyr Phe Gly Leu Asn His His His Asp Gln Leu
305 310 315 320

Ala His His Thr Val Cys Phe Gly Pro Arg Tyr Arg Glu Leu Ile His
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| Met | Ala | Val | Gly | Ser | Lys | Ser | Phe | Ala | Thr | Ala | Ser | Thr | Leu | Phe | Asp | | |
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| Ala | Lys | Thr | Arg | Arg | Ser | Val | Leu | Met | Leu | Tyr | Ala | Trp | Cys | Arg | His | | |
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| Cys | Asp | Asp | Val | Ile | Asp | Asp | Gln | Thr | Leu | Gly | Phe | His | Ala | Asp | Gln | | |
| | | 35 | | | | | 40 | | | | | 45 | | | | | |
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| ccc | tct | tcg | cag | atg | cct | gag | cag | cgc | ctg | cag | cag | ctt | gaa | atg | aaa | 192 | |
| Pro | Ser | Ser | Gln | Met | Pro | Glu | Gln | Arg | Leu | Gln | Gln | Leu | Glu | Met | Lys | | |

| 50 | 55 | 60 | |
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| tac Tyr | ggt Gly | tcg Ser | caa Gln |
| gag Glu | ccc Pro | gct Ala | ttt Phe |
| gcc Ala 80 | | | |
| gcg Ala | ttt Phe | cag Gln | gag Glu |
| gtc Val 85 | gcg Ala | atg Met | gcg Ala |
| cat His | gat Asp 90 | atc Ile | gct Ala |
| ccc Pro | gcc Ala | tac Tyr | gag Ala |
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| ttc Phe | gac Asp | cat His | ctg Leu 100 |
| gaa Glu | ggt Gly | ttt Phe | gcc Ala 105 |
| atg Met | gat Asp | gtg Val | cgc Arg |
| gaa Glu | acg Thr | cgc Arg | tac Tyr |
| | | | |
| ctg Leu | aca Thr | ctg Leu | gac Asp |
| gat Asp | acg Thr | ctg Leu | gag Thr |
| ggt Gly | ggt Gly | ttt Phe | gcc Ala 120 |
| ggt Gly | ggt Gly | ttt Phe | gcc Ala 120 |
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| gtg Val | ggc Gly | ctg Leu | atg Met |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| | | | |
| ctc Leu 145 | gat Asp | cgc Arg | gcc Ala |
| tgc Cys | gat Asp | ctc Leu | ggg Gly |
| ctg Leu | gct Ala | ttc Phe | cag Gln |
| ttg Leu | acc Thr | aac Asn | att Ile |
| | | | |
| gag Ala | cgt Arg | gat Asp | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| | | | |
| cca Pro | gaa Glu | aac Asn | cgg Arg |
| cag Gln | gcc Ala | tta Leu | agc Ser |
| cgt Arg | atc Ile | gcc Ala | ggg Gly |
| cga Arg | ctg Leu | gta Val | cgg Arg |
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| gaa Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
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| ccc Pro | ttt Leu | cgc Arg | tcg Ser |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
| | | | |
| aaa Lys | att Ile | ggc Gly | gtg Val |
| aaa Lys | att Ile | ggc Gly | gtg Val |
| aaa Lys | att Ile | ggc Gly | gtg Val |
| aaa Lys | att Ile | ggc Gly | gtg Val |
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| cgc Arg | cag Gln | tcc Ser | acc Thr |
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| | | | |
| tcc Ser | ggt Gly | cag Gln | gca Ala |
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| gag Glu | gag Glu | gag Glu | gag Glu |
| gag Glu | gag Glu | gag Glu | gag Glu |
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| tag | | | |

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Cys Asp Asp Val Ile Asp Asp Gln Thr Leu Gly Phe His Ala Asp Gln
 35 40 45

Pro Ser Ser Gln Met Pro Glu Gln Arg Leu Gln Gln Leu Glu Met Lys
 50 55 60

Thr Arg Gln Ala Tyr Ala Gly Ser Gln Met His Glu Pro Ala Phe Ala
 65 70 75 80

Ala Phe Gln Glu Val Ala Met Ala His Asp Ile Ala Pro Ala Tyr Ala
 85 90 95

Phe Asp His Leu Glu Gly Phe Ala Met Asp Val Arg Glu Thr Arg Tyr
 100 105 110

Leu Thr Leu Asp Asp Thr Leu Arg Tyr Cys Tyr His Val Ala Gly Val
 115 120 125

Val Gly Leu Met Met Ala Gln Ile Met Gly Val Arg Asp Asn Ala Thr
 130 135 140

Leu Asp Arg Ala Cys Asp Leu Gly Leu Ala Phe Gln Leu Thr Asn Ile
 145 150 155 160

Ala Arg Asp Ile Val Asp Asp Ala Gln Val Gly Arg Cys Tyr Leu Pro
 165 170 175

Glu Ser Trp Leu Glu Glu Glu Gly Leu Thr Lys Ala Asn Tyr Ala Ala
 180 185 190

Pro Glu Asn Arg Gln Ala Leu Ser Arg Ile Ala Gly Arg Leu Val Arg
 195 200 205

Glu Ala Glu Pro Tyr Tyr Val Ser Ser Met Ala Gly Leu Ala Gln Leu
 210 215 220

Pro Leu Arg Ser Ala Trp Ala Ile Ala Thr Ala Lys Gln Val Tyr Arg
 225 230 235 240

Lys Ile Gly Val Lys Val Glu Gln Ala Gly Lys Gln Ala Trp Asp His
 245 250 255

Arg Gln Ser Thr Ser Thr Ala Glu Lys Leu Thr Leu Leu Leu Thr Ala
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Ala His Leu Trp Gln Arg Pro Ile
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 Met Glu Val Val Ala Ala Leu Ala His Lys Tyr Ile Met His Gly Trp
 20 25 30
 ggt tgg ggc tgg cat ctt tca cat cat gaa ccg cgt aaa ggc gca ttt 144
 Gly Trp Gly Trp His Leu Ser His His Glu Pro Arg Lys Gly Ala Phe
 35 40 45
 gaa gtt aac gat ctc tat gcc gtg gta ttc gcc att gtg tcg att gcc 192
 Glu Val Asn Asp Leu Tyr Ala Val Val Phe Ala Ile Val Ser Ile Ala
 50 55 60
 ctg att tac ttc ggc agt aca gga atc tgg ccg ctc cag tgg att ggt 240
 Leu Ile Tyr Phe Gly Ser Thr Gly Ile Trp Pro Leu Gln Trp Ile Gly
 65 70 75 80
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 Ala Gly Met Thr Ala Tyr Gly Leu Leu Tyr Phe Met Val His Asp Gly
 85 90 95
 ctg gta cac cag cgc tgg ccg ttc cgc tac ata ccg cgc aaa ggc tac 336
 Leu Val His Gln Arg Trp Pro Phe Arg Tyr Ile Pro Arg Lys Gly Tyr
 100 105 110
 ctg aaa cgg tta tac atg gcc cac cgt atg cat cat gct gta agg gga 384
 Leu Lys Arg Leu Tyr Met Ala His Arg Met His His Ala Val Arg Gly
 115 120 125
 aaa gag ggc tgc gtg tcc ttt ggt ttt ctg tac gcg cca ccg tta tct 432
 Lys Glu Gly Cys Val Ser Phe Gly Phe Leu Tyr Ala Pro Pro Leu Ser
 130 135 140
 aaa ctt cag gcg acg ctg aga gaa agg cat gcg gct aga tcg ggc gct 480
 Lys Leu Gln Ala Thr Leu Arg Glu Arg His Ala Ala Arg Ser Gly Ala
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 gcc aga gat gag cag gac ggg gtg gat acg tct tca tcc ggg aag taa 528
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 20 25 30

Gly Trp Gly Trp His Leu Ser His His Glu Pro Arg Lys Gly Ala Phe
 35 40 45

Glu Val Asn Asp Leu Tyr Ala Val Val Phe Ala Ile Val Ser Ile Ala
 50 55 60

Leu Ile Tyr Phe Gly Ser Thr Gly Ile Trp Pro Leu Gln Trp Ile Gly
 65 70 75 80

Ala Gly Met Thr Ala Tyr Gly Leu Leu Tyr Phe Met Val His Asp Gly
 85 90 95

Leu Val His Gln Arg Trp Pro Phe Arg Tyr Ile Pro Arg Lys Gly Tyr
 100 105 110

Leu Lys Arg Leu Tyr Met Ala His Arg Met His His Ala Val Arg Gly
 115 120 125

Lys Glu Gly Cys Val Ser Phe Gly Phe Leu Tyr Ala Pro Pro Leu Ser
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Lys Leu Gln Ala Thr Leu Arg Glu Arg His Ala Ala Arg Ser Gly Ala
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Ala Arg Asp Glu Gln Asp Gly Val Asp Thr Ser Ser Ser Gly Lys
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 Page 17

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| ccgggtatgg | tattctggca | caacgacggc | tggaccatct | tccgtgaact | ggaagtgttt | 840 |
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| tcttatacac | atctcaacca | tcattcgatga | attgtgtctc | aaaatctctg | atgttacatt | 1980 |
| gcacaagata | aaaatatatc | atcatgaaca | ataaaaactgt | ctgcttacat | aaacagtaat | 2040 |
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 <213> Escherichia coli

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| cttatacaca | tctcaaccct | gaagcttgca | tgcttcgagg | tcgactctag | aggatccccg | 4200 |
| ccacggttga | tgagagcttt | gttgtagggtg | gaccagttgg | tgattttgaa | cttttgcttt | 4260 |
| gccacggaac | ggtctgcgtt | gtcgggaaga | tgctgatctt | gatccttcaa | ctcagcaaaa | 4320 |
| gttcgattta | ttcaacaaag | ccgccgtccc | gtcaagtcag | cgtaatgctc | tgccagtgtt | 4380 |
| acaaccaatt | aaccaattct | gattagaaaa | actcatcgag | catcaaatga | aactgcaatt | 4440 |
| tattcatatc | aggattatca | ataccatatt | tttgaaaaag | ccgtttctgt | aatgaaggag | 4500 |
| aaaactcacc | gaggcagttc | cataggatgg | caagatcctg | gtatcgggtc | gcgattccga | 4560 |
| ctcgtccaac | atcaatacaa | cctattaatt | ttccctcgtc | aaaaataagg | ttatcaagtg | 4620 |
| agaaatcacc | atgagtgcag | actgaatccg | gtgagaatgg | caaaagttaa | tgcatcttct | 4680 |
| tccagacttg | ttcaacaggc | cagccattac | gctcgtcatc | aaaatcactc | gcatcaacca | 4740 |
| aaccgttatt | cattcgtgat | tgcgctgag | cgagacgaaa | tacgcgatcg | ctgttaaaag | 4800 |
| gacaattaca | aacaggaatc | gaatgcaacc | ggcgaggaga | caactgccagc | gcatcaacaa | 4860 |
| tattttcacc | tgaatcagga | tattcttcta | atacctggaa | tgctgttttt | ccggggatcg | 4920 |
| cagtgggtgag | taaccatgca | tcacagagg | tacggataaa | atgcttgatg | gtcgggaagag | 4980 |

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| tacctttgcc | atgtttcaga | aacaactctg | gcgcatcggg | cttcccatac | aatcgataga | 5100 |
| ttgtcgcacc | tgattgcccc | acattatcgc | gagcccattt | atacccatat | aaatcagcat | 5160 |
| ccatgttgga | atttaatcgc | ggcctcgagc | aagacgtttc | ccgttgaata | tggtccataa | 5220 |
| cacccttgt | attactgttt | atgtaagcag | acagttttat | tgttcatgat | gatatatattt | 5280 |
| tatcttgtgc | aatgtaacat | cagagatttt | gagacacaat | tcatcgatga | tggttgagat | 5340 |
| gtgtataaga | gacaggggtga | agctccggct | gcaccgcagg | tgactgcaga | agacgcatct | 5400 |
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 <212> DNA
 <213> Escherichia coli

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| gaaaatagca | tgagtgccaa | tgaaaacaac | ctgatttgga | tcgatcttga | gatgaccggt | 120 |
| ctggatcccc | agcgcgatcg | cattattgag | attgccacgc | tggtgaccga | tgccaacctg | 180 |
| aatattctgg | cagaagggcc | gaccattgca | gtacaccagt | ctgatgaaca | gctggcgctg | 240 |
| atggatgact | ggaacgtgcg | caccataacc | gccagcgggc | tggtagagcg | cgtgaaagcg | 300 |
| agcacgatgg | gcgatcggga | agctgaactg | gcaacgctcg | aatttttaaa | acagtgggtg | 360 |
| cctgcgggaa | aatcgccgat | ttgcggtaac | agcatcggtc | aggaccgtcg | tttcctgttt | 420 |
| aaatacatgc | cggagctgga | agcctacttc | cactaccgtt | atctcgatgt | cagcaccctg | 480 |
| aaagagctgg | cgcgccgctg | gaagccggaa | attctggatg | gttttaccaa | gcaggggacg | 540 |
| catcaggcga | tggtatgat | ccgtgaatcg | gtggcggagc | tggttacta | cctgtctctt | 600 |
| atacacatct | caaccctgaa | gcttgcatgc | ctgcaggctc | actctagagg | atccccgcca | 660 |
| cggttgatga | gagctttgtt | gtaggtggac | cagttggtga | ttttgaactt | ttgctttgcc | 720 |
| acggaacggt | ctgcgttgct | gggaagatgc | gtgatctgat | ccttcaactc | agcaaaagtt | 780 |
| cgattttattc | aacaaagccg | ccgtcccgtc | aagtcagcgt | aatgctctgc | cagtgttaca | 840 |
| accaattaac | caattctgat | tagaaaaact | catcgagcat | caaatgaaac | tgcaatttat | 900 |
| tcatatcagg | attatcaata | ccatattttt | gaaaaagccg | tttctgtaat | gaaggagaaa | 960 |
| actcaccgag | gcagttccat | aggatggcaa | gatcctggta | tcggtctgcg | attccgactc | 1020 |
| gtccaacatc | aatacaacct | attaattttc | cctcgtcaaa | aataagggtta | tcaagtgaga | 1080 |
| aatcaccatg | agtgacgact | gaatccgggtg | agaatggcaa | aagtttatgc | atttctttcc | 1140 |
| agacttgttc | aacaggccag | ccattacgct | cgatcatcaa | atcactcgca | tcaaccaaac | 1200 |
| cgttattcat | tcgtgattgc | gcctgagcga | gacgaaatac | gcgatcgctg | ttaaaaggac | 1260 |
| aattacaaac | aggaatcgaa | tgcaaccggc | gcaggaacac | tgccagcgca | tcaacaatat | 1320 |
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| taaattccgt | cagccagttt | agtctgacca | tctcatctgt | aacatcattg | gcaacgctac | 1500 |
| ctttgccatg | tttcagaaac | aactctggcg | catcgggctt | cccatacaat | cgatagattg | 1560 |
| tcgcacctga | ttgcccagaca | ttatcgcgag | cccatttata | cccatataaa | tcagcatcca | 1620 |
| tgttggaatt | taatcgcggc | ctcgagcaag | acgtttcccg | ttgaatatgg | ctcataacac | 1680 |
| cccttggtatt | actgtttatg | taagcagaca | gtttttattgt | tcattgatgat | atatttttat | 1740 |
| cttggtgcaat | gtaacatcag | agattttgag | acacaattca | tcgatgatgg | ttgagatgtg | 1800 |
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<210> 40
 <211> 2334
 <212> DNA
 <213> Escherichia coli

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| gtggcgctcg | gcattattat | tgccgacagc | cgcctgggga | cgttcagtca | aatccgtact | 120 |
| tatatggata | ccgccgtcag | tcctttctac | tttgtttcca | atgctcctcg | tgaattgctg | 180 |
| gatggcgctat | cgcagacgct | ggcctcgctg | gaccaattag | aacttgaaaa | ccgggcggtta | 240 |
| cgctcaggaac | tggtgctgaa | aaacagtga | ctgctgatgc | ttggacaata | caaacaggag | 300 |
| aacgcgcgtc | tgcgcgagct | gctgggttcc | ccgctgcgtc | aggatgagca | gaaaatggtg | 360 |
| actcagggtta | tctccacggt | taacgatcct | tatagcgatc | aagttgttat | cgataaagggt | 420 |
| agcggttaatg | gcgtttatga | aggccagccg | gtcatcagcg | acaaagggtgt | tggtgggtcag | 480 |
| gtgggtggccg | tcgctaaact | gaccagtcgc | gtgctgctga | tttgtgatgc | gaccacgcg | 540 |
| ctgccaatcc | aggtgctgcg | caacgatatc | cgcgtaattg | cagccggtaa | cggttgtagc | 600 |
| gatgatttgc | agcttgagca | tctgccggcg | aatacggata | ttcgtgttgg | tgatgtgctg | 660 |
| gtgacttccg | gtctgggctg | tcgtttcccg | gaaggctatc | cggtcgcggt | tgtctcttcc | 720 |
| gtaaaactcg | ataccagcg | cgcttatact | gtgattcagg | cgcgtccgac | tgcaaggctg | 780 |
| caacgtttgc | gttatctgct | gctgctgtgg | ggggcagatc | gtaacggcgc | taaccgatg | 840 |
| acgccggaag | aggtgcatcg | tggtgcta | gaacgtctga | tgcatgat | gccgcaggta | 900 |
| ttgccttcgc | cagacgcgat | ggggccaaag | ttacctgaac | cggcaacggg | gatcgtcag | 960 |
| ccgactccgc | agcaaccggc | gacaggaaat | gcagctactg | cgcctgctgc | gccgacacag | 1020 |
| cctctgtctc | ttatacacat | ctcaaccatc | atcgatgaat | tgtgtctcaa | aatctctgat | 1080 |
| gttacattgc | acaagataaa | aatatatcat | catgaacaat | aaaactgtct | gcttacataa | 1140 |
| acagtaatac | aaggggtgtt | atgagccata | ttcaacggga | aacgtcttgc | tcgaggccgc | 1200 |
| gattaaattc | caacatggat | gctgatttat | atgggtataa | atgggctcgc | gataatgtcg | 1260 |
| ggcaatcagg | tgcgacaatc | tatcgattgt | atgggaagcc | cgatgcgcca | gagttgtttc | 1320 |

| | | | | | | |
|-------------|-------------|------------|------------|-------------|-------------|------|
| tgaaacatgg | caaaggtagc | gttgccaatg | atgttacaga | tgagatgggc | agactaaact | 1380 |
| ggctgacgga | atttatgcct | cttccgacca | tcaagcattt | tatccgtact | cctgatgatg | 1440 |
| catgggtact | caccactgcg | atccccggaa | aaacagcatt | ccaggtatta | gaagaatatc | 1500 |
| ctgattcagg | tgaaaatatt | gttgatgcmc | tggcagtgtt | cctgcgccgg | ttgcattcga | 1560 |
| ttcctgtttg | taattgtcct | tttaacagcg | atcgcgtatt | tcgtctcgct | caggcgcaat | 1620 |
| cacgaatgaa | taacggtttg | gttgatgcga | gtgattttga | tgacgagcgt | aatggctggc | 1680 |
| ctgttgaaca | agtctggaaa | gaaatgcata | aacttttgcc | attctcaccg | gattcagtcg | 1740 |
| tcactcatgg | tgattttctca | cttgataacc | ttatttttga | cgaggggaaa | ttaatagggt | 1800 |
| gtattgatgt | tggacgagtc | ggaatcgcag | accgatacca | ggatcttgcc | atcctatgga | 1860 |
| actgcctcgg | tgagttttct | ccttcattac | agaaacggct | ttttcaaaaa | tatggtattg | 1920 |
| ataatcctga | tatgaataaa | ttgcagtttc | atttgatgct | cgatgagttt | ttctaatacag | 1980 |
| aattgggttaa | ttggttgtaa | cactggcaga | gcattacgct | gacttgacgg | gacggcggct | 2040 |
| ttgttgaata | aatcgaactt | ttgctgagtt | gaaggatcag | atcacgcata | ttcccgacaa | 2100 |
| cgcagaccgt | tccgtggcaa | agcaaaagtt | caaaatcacc | aactgggtcca | cctacaacaa | 2160 |
| agctctcatc | aaccgtggcg | gggatcctct | agagtcgacc | tgcaggcatg | caagcttcag | 2220 |
| ggttgagatg | tgtataagag | acagacacag | cctgctgcta | atcgctctcc | acaaagggct | 2280 |
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<210> 41
 <211> 2676
 <212> DNA
 <213> Escherichia coli

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| ctcttataca | catctcaacc | atcatcgatg | aattgtgtct | caaaatctct | gatgttacat | 120 |
| tgcacaagat | aaaaatatat | catcatgaac | aataaaaactg | tctgcttaca | taaacagtaa | 180 |
| tacaaggggt | gttatgagcc | atattcaacg | ggaaacgtct | tgctcgaggc | cgcgattaaa | 240 |
| ttccaacatg | gatgctgatt | tatatgggta | taaatgggct | cgcgataatg | tcgggcaatc | 300 |
| aggtgcgaca | atctatcgat | tgtatgggaa | gcccgatgcg | ccagagttgt | ttctgaaaca | 360 |
| tggcaaaggt | agcgttgcca | atgatgttac | agatgagatg | gtcagactaa | actggctgac | 420 |
| ggaatttatg | cctcttccga | ccatcaagca | ttttatccgt | actcctgatg | atgcatgggt | 480 |
| actcaccact | gcgatccccg | gaaaaacagc | attccaggta | ttagaagaat | atcctgattc | 540 |
| aggtgaaaaat | attgttgatg | cgctggcagt | gttcctgcgc | cggttgcatt | cgattcctgt | 600 |
| ttgtaattgt | ccttttaaca | gcgatcgcgt | atttcgtctc | gctcaggcgc | aatcacgaat | 660 |
| gaataacgggt | ttggttgatg | cgagtgattt | tgatgacgag | cgtaatggct | ggcctgttga | 720 |
| acaagtctgg | aaagaaatgc | ataaactttt | gccattctca | ccggattcag | tcgtcactca | 780 |
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| tgatatgaat | aaattgcagt | ttcatttgat | gctcgatgag | tttttcta | cagaattggt | 1020 |
| taattggttg | taacactggc | agagcattac | gctgacttga | cgggacggcg | gctttgttga | 1080 |
| ataaatcgaa | cttttgctga | gttgaaggat | cagatcacgc | atcttcccga | caacgcagac | 1140 |
| cgttccgtgg | caaagcaaaa | gttcaaaatc | accaaactgg | ccacctacaa | caaagctctc | 1200 |
| atcaaccgtg | gcggggatcc | tctagagtcg | acctgcaggc | atgcaagctt | caggggttga | 1260 |
| atgtgtataa | gagacagttt | cagttctgcg | tactctcctg | tgaccaggca | gcgaaaagac | 1320 |
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| aacaaaatcc | tctttgagaa | cttaaccccg | ctgcacgcaa | actctcgtct | gcgtatggaa | 1860 |
| cgtggttaacg | gttctactga | agatttaact | gctcgcgtac | tggatctggc | atcacctatc | 1920 |
| ggtcgtggtc | agcgtgggtc | gattgtggca | ccgccgaaag | ccggtaaaac | catgctgctg | 1980 |
| cagaacattg | ctcagagcat | tgcttacaac | cacccggatt | gtgtgctgat | ggttctgctg | 2040 |
| atcgacgaac | gtccggaaga | agtaaccgag | atgcagcgtc | tggtaaaagg | tgaagttggt | 2100 |
| gcttctacct | ttgacgaacc | cgcattctgc | cacgttcagg | ttgcggaaat | ggtgatcgag | 2160 |
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| atcgctgaaa | aacgcgtctt | cccggctatc | gactacaacc | gttctggtac | ccgtaaagaa | 2520 |
| gagctgctca | cgactcagga | agaactgcag | aaaatgtgga | tcctgcgcaa | aatcattcac | 2580 |
| ccgatgggcg | aaatcgatgc | aatggaattc | ctcattaata | aactggcaat | gaccaagacc | 2640 |
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 <211> 1746
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<211> 8609
<212> DNA
<213> Artificial sequence

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<220>

<223> Reporter plasmid pPCB15

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